Pneumonia in the Elderly

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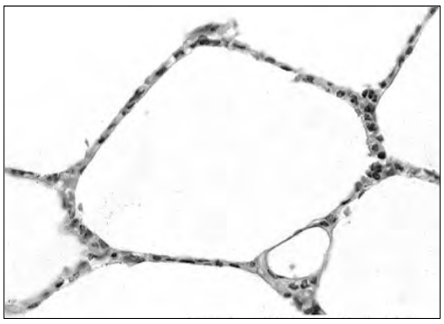
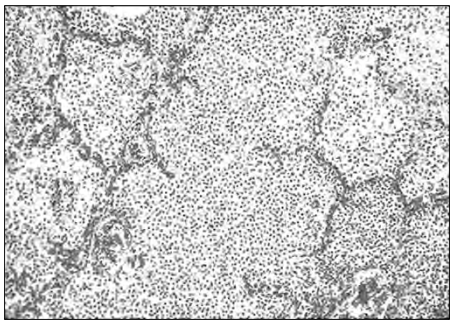
Outline

- Pneumonia in the Elderly Background
- Practical Clinical Approach to Managing Pneumonia in the Elderly
  - Is it pneumonia?
  - How bad is it?
  - What is the likely cause?
  - What is the best treatment?
  - How should it respond to treatment?
  - What if it doesn't respond?

What is Pneumonia?

- Inflammation of the lung parenchyma
- Usually caused by infection and the associated host inflammatory response





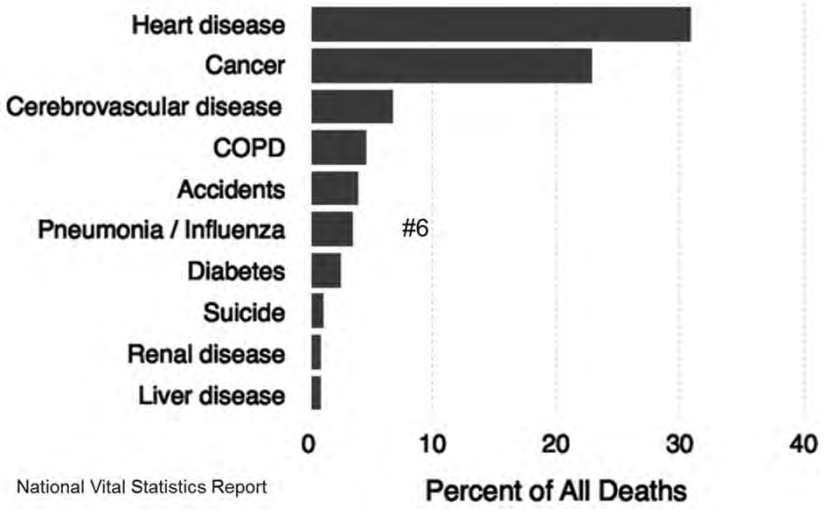
What is Elderly?

- >50
- >62
- >65
- >100

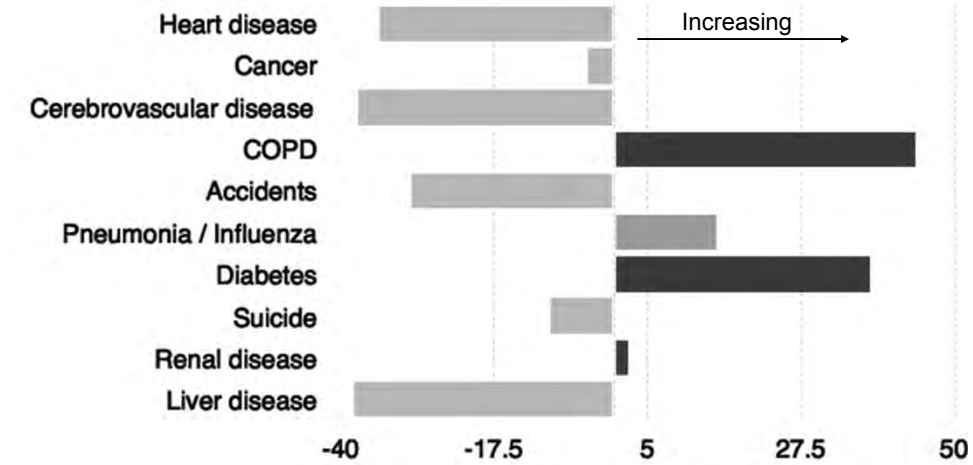
Pneumonia Epidemiology in USA

- Community-Acquired Pneumonia
  - 2-4 million cases per year
  - >500,000 require hospitalization (~20%)
  - Mortality <2-50%
  - 10 million physician contacts
  - $20 billion in annual expenditures
  - 6th leading cause of death
  -
- Leading contributor to global “burden of disease”

Current Pneumonia Epidemiology: Top Ten Causes of Death in USA



Current Pneumonia Epidemiology: Trends in Causes of Death in USA



National Vital Statistics Report

Lung Consolidation

Pneumonia Pathogenesis

- Routes of Lung Inoculation
  - Aspiration
  - Inhalation
  - Hematogenous
  - Contiguous spread
- Determinants of Infection
  - Virulence of pathogen
  - Inoculum
  - Status of host defenses

Lung Host Defenses

- Anatomic Barriers
- Airway Reflexes
- Mucociliary Clearance
- Soluble Factors
- Cellular Defenses
  - Phagocytes and Innate Immunity
  - Cell-mediated Immunity

Risk Factors for Getting Pneumonia

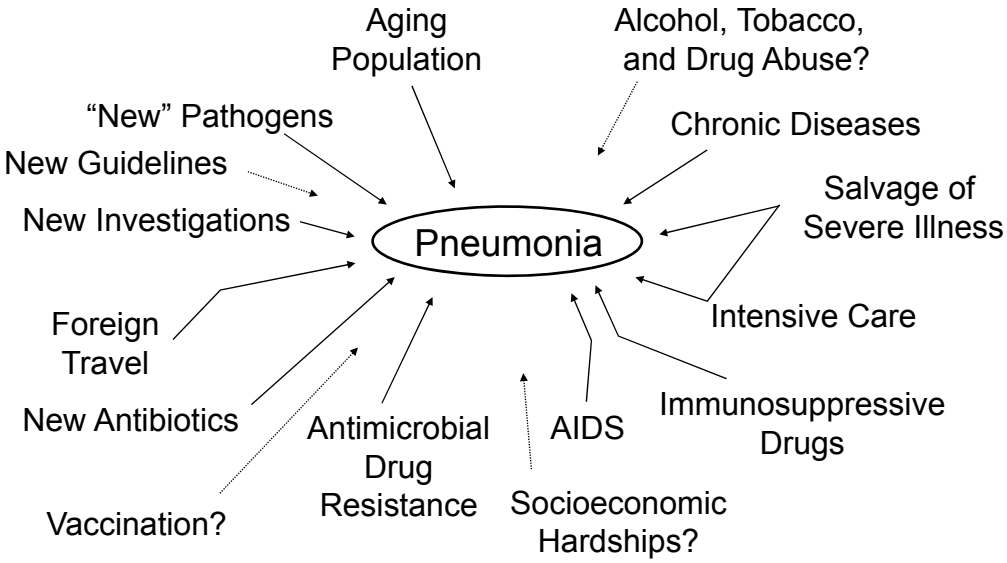
- Extremes of Age
- Smoking, Alcoholism, or Injection Drug Use
- Comorbidity (esp. COPD, CHF, Diabetes)
- Aspiration Propensity (Seizure, LOC, Dysphagia)
- Airway Abnormality (Bronchiectasis, Cancer, FB)
- Immunodeficiency (HIV/AIDS, Cancer, Drugs)
- Exposure to a Virulent Pathogen (Influenza)

Common Host Defense Defects in Community Acquired Pneumonia

Risk Factor (Host Defect)	Harborview 1994-96 (n 523)	Hopkins 1990-91 (n 385)
Smoking	65 %	49 %
Alcohol	41	29
COPD	15	?
IVDU	14	41
HIV	22	47
Immunosuppressive therapy	5	8

Park et al. JID 2001; 184:268
Mundy et al. AJRCCM 1995; 152:1309

The Changing Face of Pneumonia



Modern Pneumonia Terminology

- Community-Acquired Pneumonia (CAP)
  - Severe CAP subset
- Healthcare-Associated Pneumonia (HCAP)
  - May be Community-Acquired but…Institutionalized, Immunocompromised, Recent Antibiotic Therapy or Hospitalization
- Hospital-Acquired Pneumonia (HAP)
- Ventilator-Associated Pneumonia (VAP)
- Ventilator-Associated Tracheobronchitis (VAT)

Community-Acquired Pneumonia

- Common cause of morbidity and mortality
- Growing in importance, unlike many other causes of mortality
- Known risk factors are common
- Specific etiologic diagnosis possible, but guidelines favor empiric antibiotic therapy based on the clinical setting, pneumonia severity, and risk factors for drug resistant pathogens

Clinical Approach to Pneumonia:

- Is it pneumonia?
- How bad is it?
- What is the likely cause?
- What is the best treatment?
- How should it respond to treatment?
- What if it doesn't respond?

Community-Acquired Pneumonia

- Case Definition:
  - Acute illness
  - Appropriate clinical features (usually 2 or more of fever, cough, chest pain, sputum production, dyspnea, rigors, sweats, confusion, abnormal chest exam findings, or leukocytosis)
  - New radiographic infiltrate

Clinical Presentation of CAP Varies with Age

Symptoms	Prevalence (%) by age group			
	18-44	45-64	65-74	≥75 yrs
Cough*	90	84	80	84
Dyspnea*	75	72	71	66
Sputum	64	62	65	64
Pleurisy*	60	42	32	31
Fatigue*	93	93	88	84
Fever*	85	75	60	53
Chills*	85	75	60	52
Tachypnea*	36	44	68	65

* significant differences across age groups

Metlay et al. Arch Intern Med 1997; 157:1453-1459

Predictors of Pneumonia (Infiltrate) in Patients with Acute Cough

- Symptoms
  - Fever
  - Night sweats
  - Sputum production
  - Myalgias
- Signs
  - T >37.8
  - P >100
  - RR >25
  - Rales
  - Decreased breath sounds
- Absence of …
  - Asthma
  - Sore throat
  - Rhinorrhea

Diehr et al. J Chron Dis 1984; 37:215-225
Heckerling et al. Ann Intern Med 1990; 113:664-670
Metlay et al. JAMA 1997; 278:1440-1445

Use of Biomarkers in Community-Acquired Pneumonia

- Pro-calcitonin: elevated levels predict CAP, sepsis, and worse outcomes; response of levels can guide duration of antibiotic therapy
- CRP: low levels exclude CAP, failure of levels to fall predicts prolonged course and worse outcomes
- Pro-ANP: not adequately evaluated in CAP
- Adrenomedulin: levels correlate with CAP severity and high levels predict mortality
- Cortisol: relative adrenal insufficiency
- D-dimers: non-specific

Seligman et al. Biomarkers in community-acquired pneumonia: a state-of-the-art review. Clinics (Sao Paulo). 2012 Nov;67(11):1321-5.

Is it Really Pneumonia? Consider Noninfectious Mimics

Common Lung Conditions

- Pulmonary embolism
- Myocardial infarction
- Congestive heart failure
- Atelectasis
- Bronchogenic carcinoma
- Hemorrhage
- Contusion

Other Causes of Pneumonitis

- Chemical or toxic inhalation
- Hypersensitivity pneumonitis
- Eosinophilic pneumonia
- Cryptogenic organizing pneumonia
- Sarcoidosis
- Vasculitis
- Drug-induced or Radiation pneumonitis

Identifying Pneumonia Summary

- Clinical features of pneumonia vary with age
- Clinical prediction rules identify patients likely to have pneumonia
- Biomarkers may contribute and can help to guide management, but require further study
- Beware of mimics of pneumonia

Clinical Approach to Pneumonia:

- Is it pneumonia?
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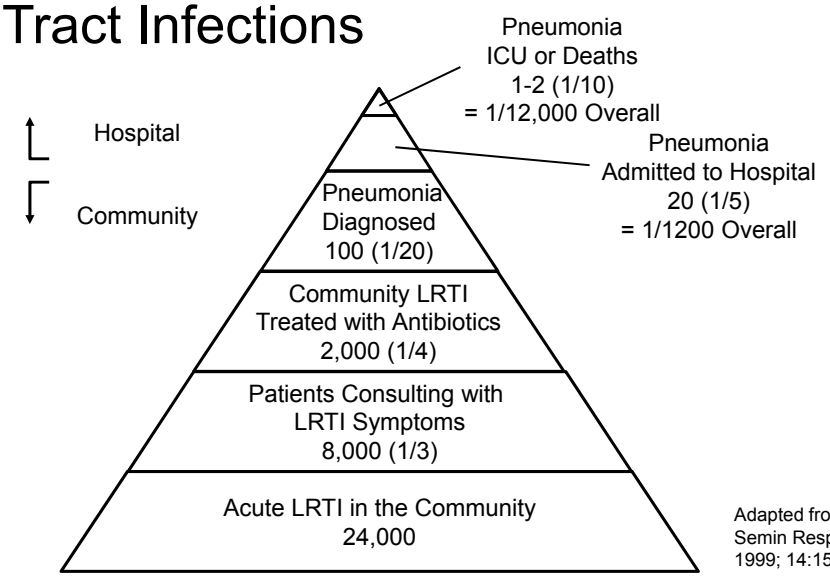
Why Assess Pneumonia Severity?

Potential Usefulness:

- Prognostication
- Clue to Microbial Causes
- Guide to Antimicrobial Selection
- Guide to Triage Decisions
  - Inpatient versus Outpatient Management
  - ICU versus Ward level of Care

The Spectrum of Lower Respiratory Tract Infections



Adapted from Macfarlane. Semin Respir Infect 1999; 14:151

Community-Acquired Pneumonia: Risk Factors for Mortality

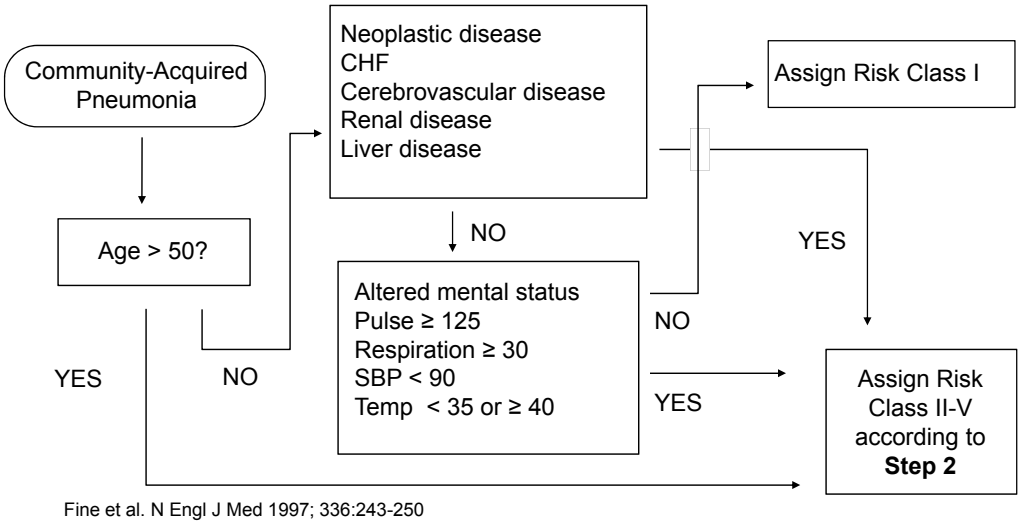
Patient Factors	Coexisting Illness	Physical Findings	Laboratory Results
Age > 65	COPD	RR > 30	WBC < 4 or > 30K
Aspiration	Diabetes	Fever > 38.3	Hgb/Hct < 9/30
	Chronic Renal Failure	BP < 90/60	PaO2 < 60
	Chronic Liver Disease	Extrapulmonary	PaCO2 > 50
	Chronic Heart Failure	Involvement	BUN/Cr > 20/1.2
	Recent Hospitalization	Altered MS	Acidosis
	Post-splenectomy		Coagulopathy
Others:	Alcohol Abuse	Pressors	Unfavorable CXR
Bacteremia			
Radiographic progression			
Absence of pleuritic CP			
High risk pathogen			

Niederman et al. Am Rev Respir Dis 1993; 148:1418-1426

Which Patients with CAP can be Safely Managed at Home?

- Avoidance of hospitalization is appealing…
  - Patient preferences
  - Cost savings and avoidance of complications
- …if "low-risk" patients can be identified
  - PORT prediction rule--aka Pneumonia Severity Index (PSI)
  - Developed to predict CAP patients with a low risk of complications or mortality
  - Extrapolated to guide hospitalization decision

Pneumonia Severity Index (PSI): Step 1 - identify those with least risk



Fine et al. N Engl J Med 1997; 336:243-250

Pneumonia Severity Index (PSI): Step 2 - add up the points

Demographic:		Physiologic:		Laboratory:	
Age (men)	+ years	Altered MS	+20	pH < 7.35	+30
Age (women)	+ years -10	RR ≥ 30	+20	BUN ≥ 30	+20
NH Resident	+10	SBP < 90	+20	Na < 130	+20
		Temp	+15	Glu ≥ 250	+10
Comorbidity:		Pulse ≥ 125	+10	Hct < 30	+10
Neoplasia	+30			PaO2 < 60	+10
Liver disease	+20			Pleural fluid	+10
CHF	+10				
CVD	+10				
Renal disease	+10				

Fine et al. N Engl J Med 1997; 336:243-250

Pneumonia Severity Index (PSI) Results

Risk Class (points)	MedisGroups Derivation Cohort		PORT Outpatient Validation Cohort		
	#	% died	#% died		% hospitalized
I	1372	0.4	587	0	5.1
II (≤ 70)	2412	0.7	244	0.4	8.2
III (71-90)	2632	2.8	72	0	16.7
IV (91-130)	4697	8.5	40	12.5	20
V (> 130)	3086	31.1	1	0	0
Total	14,199	10.2	944	0.6	7.4 (all lived)

Could save 26% of all Admissions

Fine et al. N Engl J Med 1997; 336:243-250

Pneumonia Severity Index (PSI) Potential Problems

- Highly dependent on Age
- Doesn't adequately weight extreme values (severe hypoxemia, hypotension, etc.)
- Neglects non-medical indications for hospital admission (social support, homelessness, substance abuse, need for inpatient management of comorbid conditions, etc.)
- Emphasis on low risk end of the spectrum

Which Patients with CAP should be managed in an Intensive Care Unit?

- ICU care is obvious when there is established shock or respiratory failure
- Need means to identify patients with high risk of subsequent physiological deterioration
- ATS "severity" criteria are too sensitive
- CURB-65 prediction rule:
  - Confusion, uremia (BUN ≥ 20), respiratory rate (≥ 30), Low DBP ≤ 60, Age ≥ 65
  - High risk for death if two or more present (relative risk up to 36)

Pneumonia Severity Summary

- Clinical judgment remains critical
  - Note worrisome (even if low-scoring) features
  - Consider “social indications” for admission
- Quantitative prediction rules
  - May identify candidates for outpatient care (PSI)
  - May identify candidates for ICU admission (CURB-65)

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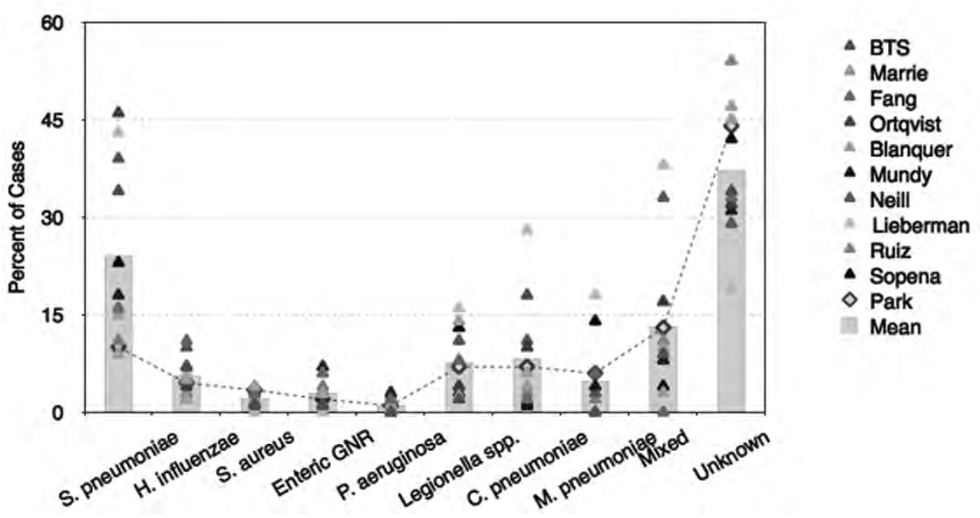
Presenting Clinical Features are Unreliable for Predicting CAP Etiology

- "Typical" pneumonia
  - Abrupt onset
  - Productive cough
  - Pleuritic CP common
  - Mild systemic symptoms
  - WBC > 10K
  - Causes: Typical bacteria
- "Atypical" pneumonia
  - Insidious onset
  - Nonproductive cough
  - Chest pain uncommon
  - Prominent systemic sx
  - WBC < 10K
  - Causes: Viruses, Mycoplasma, Chlamydia

Community CAP Etiology Studies

Organism	Prevalence
S. pneumoniae	10-60%
H. influenzae	3-10%
M. pneumoniae	5-20%
C. pneumoniae	5-17%
L. pneumophila	2-8%*
S. aureus	3-5%
Aerobic GNR	3-10%
Anaerobes	6-10%
Viruses	2-15%
Mixed infections	0-65%

Microbial Causes of Community-Acquired Pneumonia



Community CAP Etiology Studies

Study	Location	n	Year	Leading Cause
BTS	UK	453	1987	S. pneumoniae
Marrie	Canada	719	1989	S. pneumoniae
Fang	USA	359	1990	S. pneumoniae
Ortqvist	Sweden	277	1990	S. pneumoniae
Blanquer	Spain	510	1991	S. pneumoniae
Mundy	USA	385	1995	S. pneumoniae
Neill	New Zealand	255	1996	S. pneumoniae
Lieberman	Israel	346	1996	S. pneumoniae
Ruiz	Spain	395	1999	S. pneumoniae
Sopena	Czech	343	1999	S. pneumoniae
Park	USA	522	2001	S. pneumoniae

Recommended Diagnostic Studies (for Hospitalized Patients)

- Sputum Gram stain and culture
- Blood cultures
- CBC
- Chemistries
- SaO2 ± ABG
- HIV
- ± Legionella Ag, AFB studies, serologies, amplification tests, thoracentesis, other invasive testing depending on the clinical situation

Pneumonia Etiology Summary

- CAP can be caused by many and varied pathogens
- The causative pathogen can be identified in only half of CAP cases
- Typical and Atypical pneumonia features fail to accurately predict the cause
- These features encourage guideline-based empiric treatment
- *S. pneumoniae* remains the leading cause in nearly all CAP etiology studies

Clinical Approach to Pneumonia:

- Is it pneumonia?
- How bad is it?
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- What is the best treatment?
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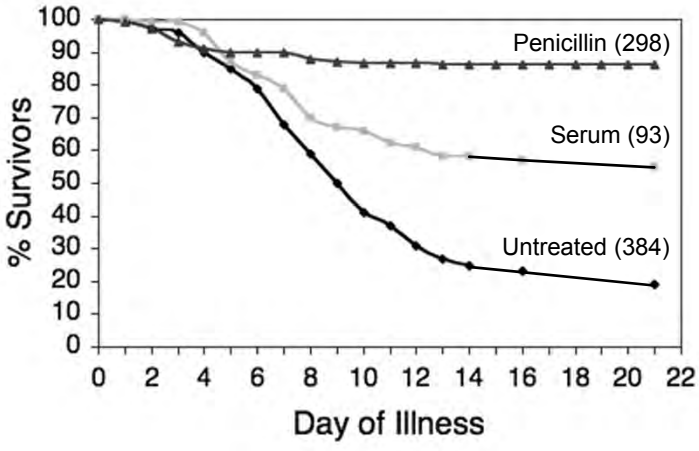
Influence of Treatment on Mortality of Bacteremic Pneumococcal Pneumonia



Austrian and Gold
Brooklyn 1952-62

Tilghman and Finland
Boston 1929-35

Austrian and Gold. AIM 1964; 60:759

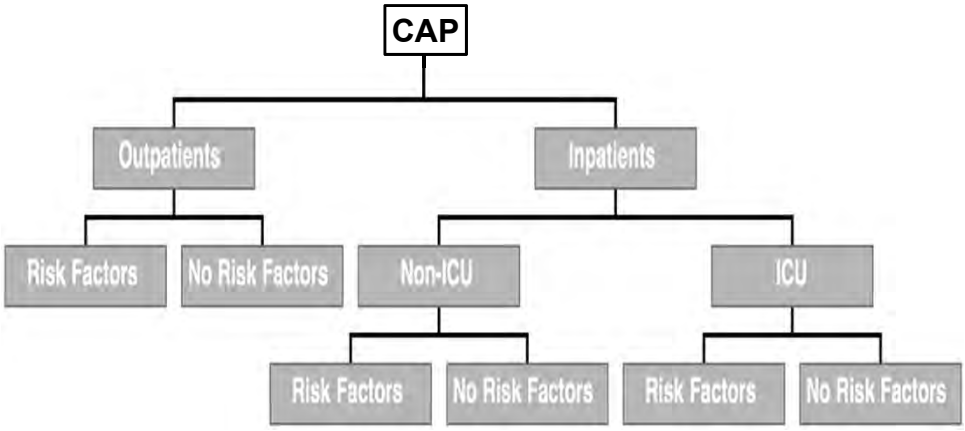
Factors that Influence CAP Mortality

- Age
- Comorbidity
- Initial Severity
- Microbial Cause
- Management
  - Site or Provider of Care
  - Supportive Care Decisions
  - Antibiotic Therapy Choice and Timing *

Guideline-Based CAP Management

- Address variability in care decisions
- Standardize approaches to triage decisions, diagnostic evaluation, antibiotic selection, and follow-up
- ATS/IDSA/others speak with one voice
- Concerns about Conflicts of Interest between CAP experts and antibiotic makers have delayed guideline updates

ATS/IDSA CAP Guidelines
Empiric Antibiotic Selection



Modifying Factors that Increase the Risk of Infection with Specific Pathogens

- PRSP
  - Age >65
  - β-lactam Rx within 3 months
  - Alcoholism
  - Immuno-suppression
  - Multiple comorbidities
  - Exposure to day care child
- Enteric GNB
  - NH Residence
  - Cardiopulmonary disease
  - Multiple comorbidities
  - Recent antibiotic
- Pseudomonas
  - Bronchiectasis
  - Corticosteroid Rx (>10 mg/day)
  - Broad-spectrum antibiotic (>7 days past month)
  - Malnutrition

ATS Guidelines. AJRCCM 2001; 163:1730-1754

Treatment of Outpatients without Cardiopulmonary Disease or Modifying Factors

- Organisms
  - S. pneumoniae
  - M. pneumoniae
  - C. pneumoniae
  - H. influenzae
  - Viruses
  - Miscellaneous (Legionella, TB, fungi)
- Therapy (oral)
  - Advanced generation macrolide

  or
  - Doxycycline

Outpatients with Cardiopulmonary Disease and/or Modifying Factors

- Organisms
  - S. pneumoniae (DRSP)
  - M. pneumoniae
  - C. pneumoniae
  - Mixed infection
  - H. influenzae
  - Enteric GNB
  - Viruses
  - Miscellaneous (Aspiration, M. catarrhalis, Legionella, TB, fungi)
- Therapy (oral)
  - β-lactam (cefpodoxime, cefuroxime, or amoxicillin)

    plus

    Macrolide or Doxycycline

    or
  - Anti-pneumococcal fluoroquinolone

Inpatients (not in ICU) without Cardiopulmonary Disease or Modifying Factors

- Organisms
  - S. pneumoniae
  - H. influenzae
  - M. pneumoniae
  - C. pneumoniae
  - Mixed infection
  - Viruses
  - Legionella spp.
  - Miscellaneous (TB, fungi, PCP)
- Therapy (IV)
  - Azithromycin

  or
  - Doxycycline and β-lactam

  or
  - Anti-pneumococcal Fluoroquinolone

Inpatients (not in ICU) with Cardiopulmonary Disease or Modifying Factors

- Organisms
  - S. pneumoniae (DRSP)
  - H. influenzae
  - M. pneumoniae
  - C. pneumoniae
  - Mixed infection
  - Enteric GNB
  - Aspiration
  - Viruses
  - Legionella spp.
  - Miscellaneous (TB, fungi, PCP)
- Therapy (IV)
  - β-lactam (cefotaxime, ceftriaxone, ampicillin)

    plus either

    Macrolide or Doxycycline

    or
  - Anti-pneumococcal Fluoroquinolone

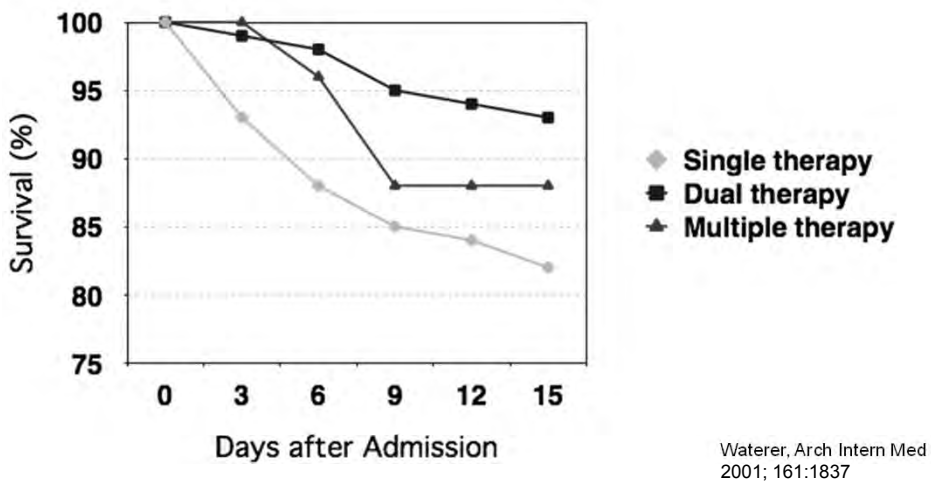
Combination Therapy

"Dr. Urbino arose at the crack of dawn, when he began to take his secret medicines: potassium bromide to raise his spirits, salicylates for the ache in his bones when it rained, ergosterol drops for vertigo, belladonna for sound sleep. He took something every hour...

in his pocket he always carried a little pad of camphor that he inhaled deeply when no one was watching to calm his fear of so many medicines mixed together."

- Gabriel Garcia Marquez
Love in the Time of Cholera

Initial Antibiotic Therapy and Outcome of Bacteremic Pneumococcal Pneumonia



Waterer, Arch Intern Med 2001; 161:1837

Beta-lactam monotherapy non-inferior to combination therapy in less severe CAP CAPCAPCAP Patients

- 656 patients admitted to non-ICU beds in Belgium
- Cluster randomized crossover design using Βετα-lactam/macrolide, Fluoroquinolone, and Beta-lactam mono therapy
- No difference in 90 day mortality (9-11%), duration of hospital stay, and time until conversion to oral antibiotic

Postma DF et al. N Engl J Med 2015; 372:1312-1323

"I must tell you that the drug that cured you has been proven completely ineffective."

ICU Patients without Risk Factors for Pseudomonas

- Organisms
  - S. pneumoniae (DRSP)
  - Legionella spp.
  - H. influenzae
  - Enteric GNB
  - S. aureus
  - M. pneumoniae
  - Viruses
  - (Aspiration)
  - Miscellaneous (C. pneumoniae, TB, fungi)
- Therapy (IV)
  - β-lactam (cefotaxime, ceftriaxone, ampicillin)

    plus either

    Macrolide or Fluoroquinolone

ICU Patients with Risk Factors for Pseudomonas

- Organisms
  - All the above

    plus
  - P. aeruginosa
- Therapy (IV)
  - Anti-pseudomonal β-lactam (cefipime, imipenem, meropenem, piperacillin)

    plus

    Anti-pseudomonal Fluoroquinolone

    or plus

    Anti-pseudomonal AG and either Macrolide or Nonpseudomonal Fluoroquinolone

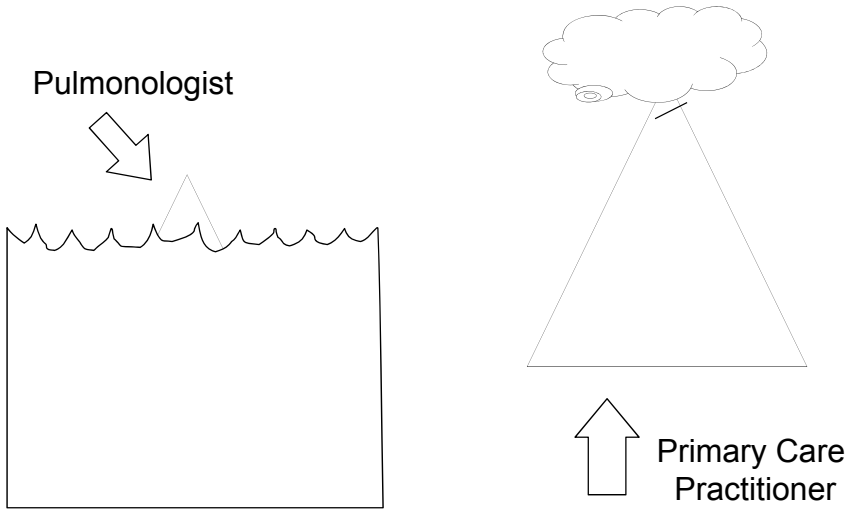
Treatment of Pneumonia Summary

- Pneumonia patients should be given empiric antibiotic therapy based on the severity of their illness and their risk factors for drug resistant pathogens
- Specific therapy may be indicated if a unique pathogen is identified
- The role of pathogen-directed therapy for routine pneumonia pathogens is uncertain

CAP Treatment Failure

- Clinical deterioration at any time, or lack of improvement after 3-7 days
- Distinct from:
  - Non-resolving pneumonia
  - Delayed radiographic resolution
  - Recurrent pneumonia
  - Secondary nosocomial pneumonia

Specialist and Generalist Perspectives on Pneumonia



Potential Explanations for CAP Treatment Failure

Wrong diagnosis (not pneumonia)

- Pulmonary complication of systemic disease
- Noninfectious pulmonary disorder

Potential Explanations for CAP Treatment Failure

Correct diagnosis (CAP), but …

- Patient Factors
  - Immunocompromised (e.g. HIV, corticosteroids)
  - Physiologically compromised (e.g. COPD, neuromuscular weakness)
  - Anatomic problems (e.g. bronchial obstruction due to cancer)

Potential Explanations for CAP Treatment Failure

Correct diagnosis (CAP), but …

- Microbial Factors
  - Extremely virulent pathogen (e.g. Influenza virus)
  - Unusual or unexpected pathogen (e.g. TB, PC, Fungus, etc.)
  - Resistant pathogen (e.g. PRSP, MRSA, GNB, Viruses, etc.)

Potential Explanations for CAP Treatment Failure

Correct diagnosis (CAP), but …

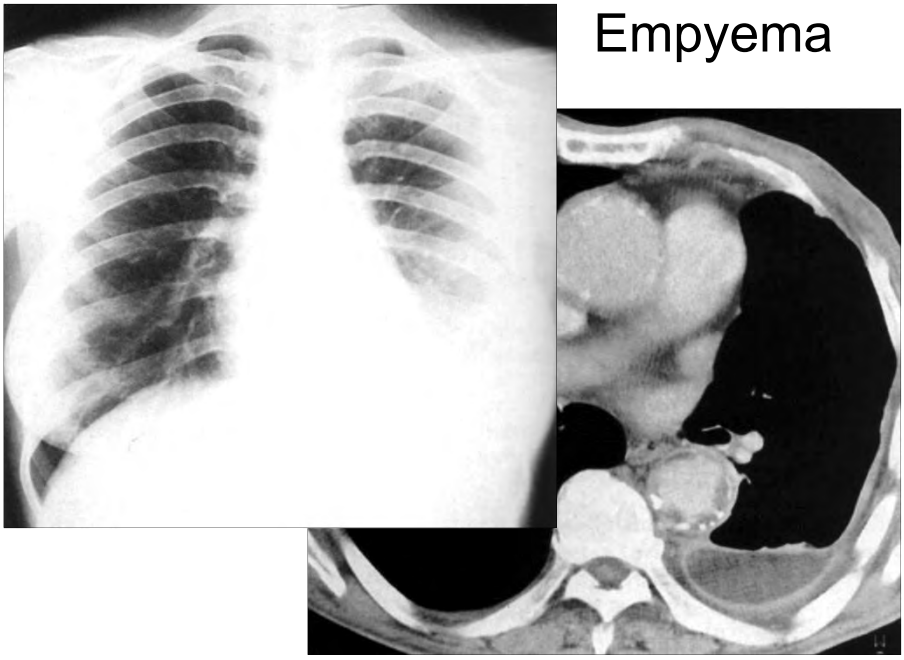
- Antibiotic factors
  - Pharmacodynamic problems (e.g. antimicrobial spectrum)
  - Pharmacokinetic problems (e.g. dose or bioavailability)
  - Patient noncompliance
  - System / administration failure

Potential Explanations for CAP Treatment Failure

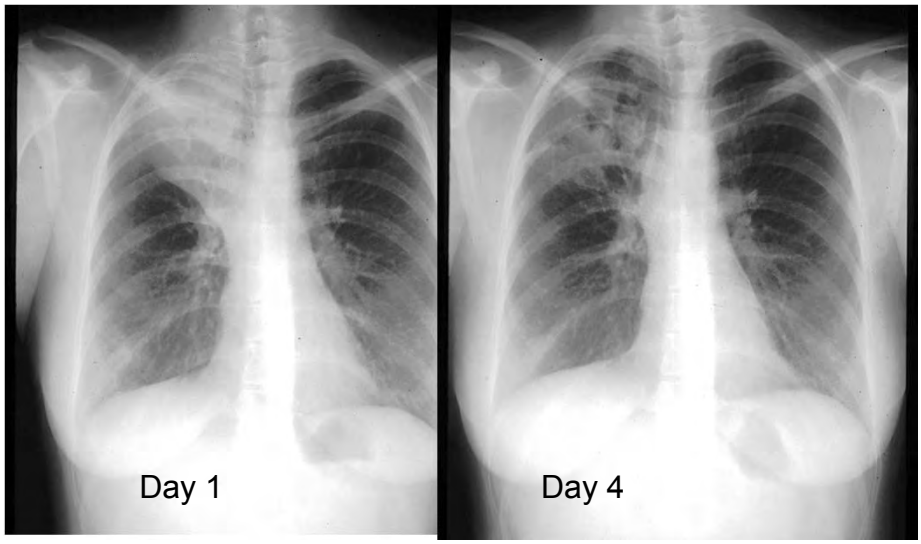
Correct diagnosis (CAP), but …

- Disease Factors
  - Infectious complications (e.g. empyema, abscess, sepsis, etc.)
  - Non-infectious complications (e.g. ARDS, COP, etc.)

Empyema



Necrotizing Pneumonia



Approach to Treatment Failure in Community-Acquired Pneumonia

- Review history
  - Contacts, exposures, drugs, travel
  - Transmissibility
- Repeat physical examination
  - Vital signs, mental status, secretion management
  - Pleural collection?
  - Airflow obstruction?
  - Metastatic site of infection?

Approach to Treatment Failure in Community-Acquired Pneumonia

- Confirm antibiotic dose / administration
- Review existing laboratory data
  - Microbiological results
  - Antimicrobial susceptibilities
- Check local epidemiologic trends

Approach to Treatment Failure in Community-Acquired Pneumonia

- Repeat CXR
  - Progression?
  - Cavitation, adenopathy, pleural involvement?
- Consider
  - Repeat microbiological studies (beware false+)
  - Thoracentesis
  - Chest CT (?cavity, empyema, adenopathy, obstruction)
  - Bronchoscopy?

Impact of Antibiotic Therapy on Bacterial Flora and Sputum Cx

- Pneumococcal pneumonia (n = 85)
- Sputum and TTA cultured before/after antibiotic therapy

	Sputum		TTA	
	Before	After	Before	After
S. pneumoniae	73	0	85	0
H. influenzae	1	0	8	3
S. aureus	13	37	0	2
Enteric GNB	4	84	0	5
P. aeruginosa	0	16	0	1

Benner et al. West J Med 1974; 121:173-178

Comparisons of Generalist and Specialist Management of CAP

- No direct comparisons
- Hospitalists accomplish shorter LOS, but discharge more patients with “unstable” clinical parameters

  (Rifkin, Mayo Clin Proc 2002; 77:1053)
- Consultation rare overall (12%) even among Hospitalized (20%) and Dying patients (21%)

  (Dean, Chest 2000; 117:393)

CAP Management by PCPs

- CAP Management (Dx and initial Rx) at a German Primary Care Hospital compared with ERS guidelines
- Prospective, observational, n 232
- Results:
  - Many low risk patients admitted (24%)
  - No association of diagnostics use and severity
  - Overtreatment in low risk group (55%)
  - Undertreatment in severe group (86%) associated with Failures and increased LOS

Ewig et al. Respir Med 2000; 94:556

Pulmonary and/or ID Consultation in CAP

Advantages

- Two heads are better than one
- Experience with infectious and non-infectious pulmonary diseases
- Specialized ID procedures (swabs, titers, probes, etc.)
- Specialized PCCM procedures (bronchoscopy, thoracentesis, chest tube, etc.)
- Intensive supportive care (management of secretions, respiratory failure, shock, etc.)

Pulmonary and/or ID Consultation in CAP

Disadvantages

- Two heads cost more than one
- Managed care pressures
- Lessened PCP role/stature
- More costly tests and morbid procedures
- No proven link to better outcomes

Summary

- CAP is common and potentially serious
- Failure to respond to antibiotic treatment
- Treatment failure should prompt review of H&P, lab data, antibiotic, CXR, and consideration of additional diagnostic studies
- Consultation is recommended for severe CAP, and for Treatment failures when specialty intervention is needed or when no cause can be determined

Prevention of Pneumonia

- Influenza Vaccination
- Pneumococcal Vaccination
- Smoking Cessation
- Alcohol Moderation
- Germ Avoidance

Pneumonia Summary

- CAP is an enormous health problem with known risk factors and pathogenesis
- Clinical prediction rules and biomarkers can help identify CAP and triage CAP patients to the appropriate care setting
- Causes of CAP can be predicted by patient characteristics and by severity of illness
- Empiric antibiotic therapy for CAP should be based on guideline recommendations

Pneumonia Cases

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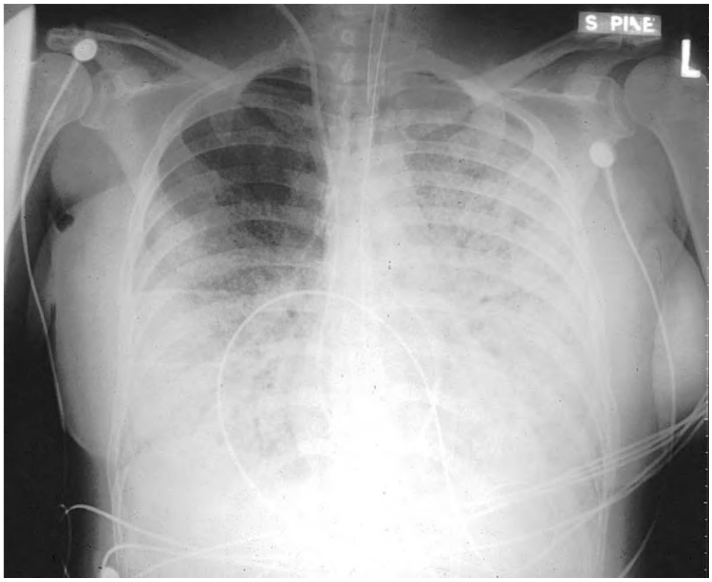
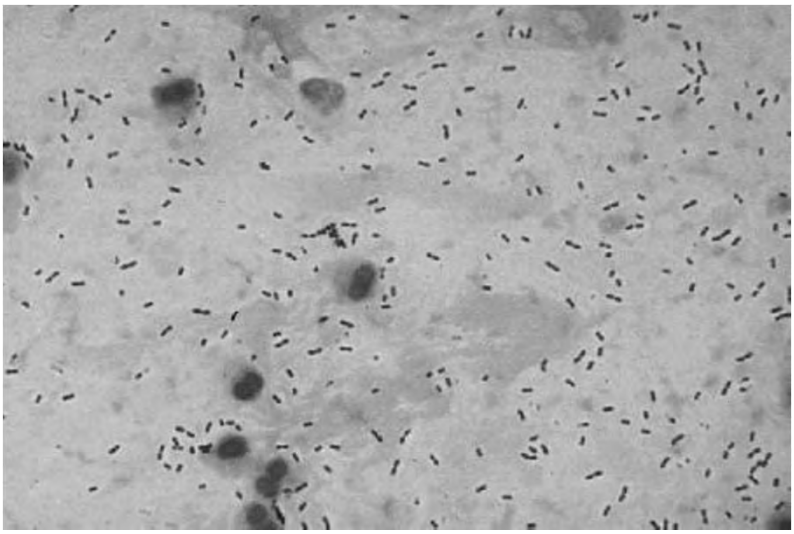
Case 2

- History
  - 64 year old woman
- Examination
  - Confused but felt unwell for several days
  - Nonproductive cough and dyspnea prompted ER visit
  - Chronic alcoholism
- Laboratory
  - WBC 18K with toxic granulation, Cr 1.8, Bilirubin 4.5
  - ABG (FiO2 1.0) 7.38/27/148

Case 2 -- CXR



Case 2 -- sputum Gram stain



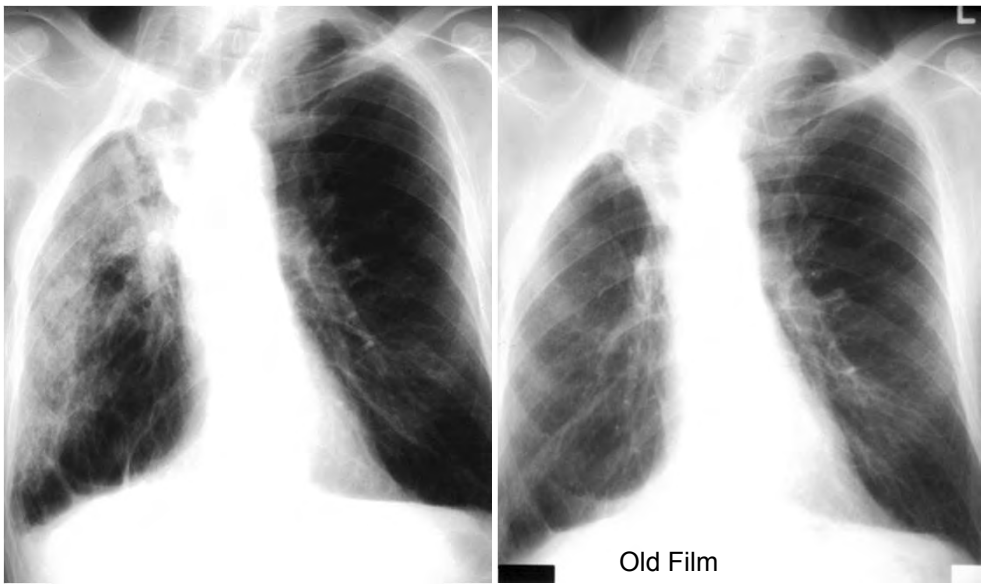
Streptococcus pneumoniae

Pneumococcal pneumonia, septic shock, and ARDS (Severe CAP)

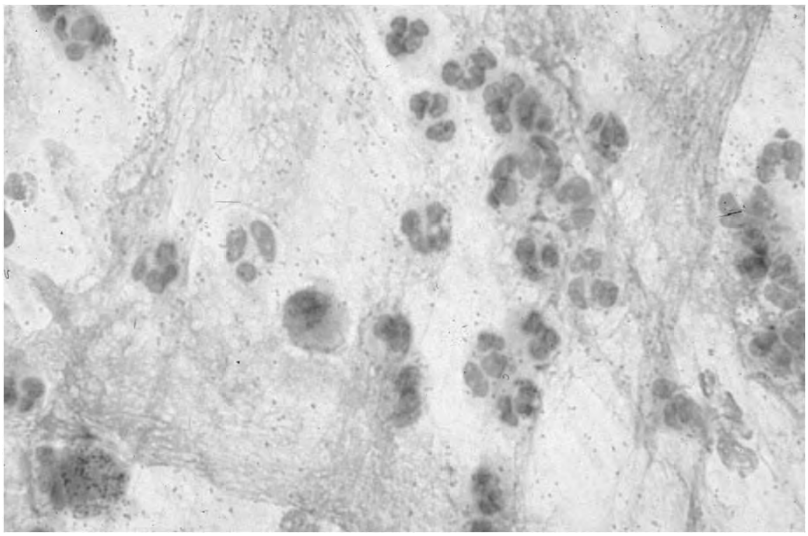
Case 3

- History
  - 74 year old man
  - 3 months refractory cough, scant sputum, fever, weight loss
  - Improved transiently after 3 courses of antibiotics
  - s/p thoracoplasty for treatment of TB as a young man
- Examination
  - T37.9, P80, R20, BP160/90
  - Gaunt, neatly attired elderly man accompanied by wife
  - Chest wall deformity with diminished BS on right

Case 3 -- CXR



Case 3 -- BAL cytospin Gram stain

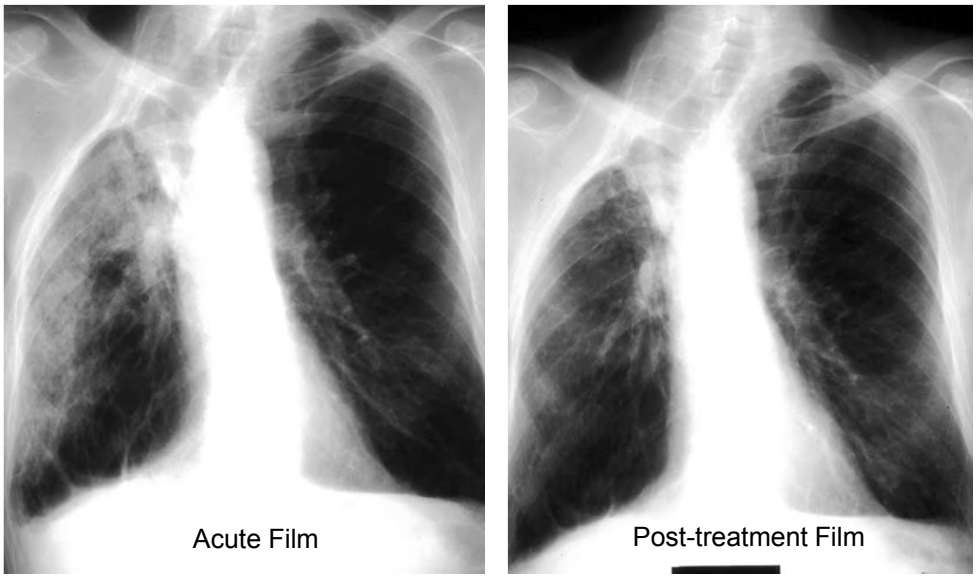


Haemophilus influenzae

Case 3 continued

- Chronic pneumonia syndrome
- Common causes include typical pneumonia pathogens
- Clinical course more indolent
- Prolonged treatment duration required (4-6 weeks)

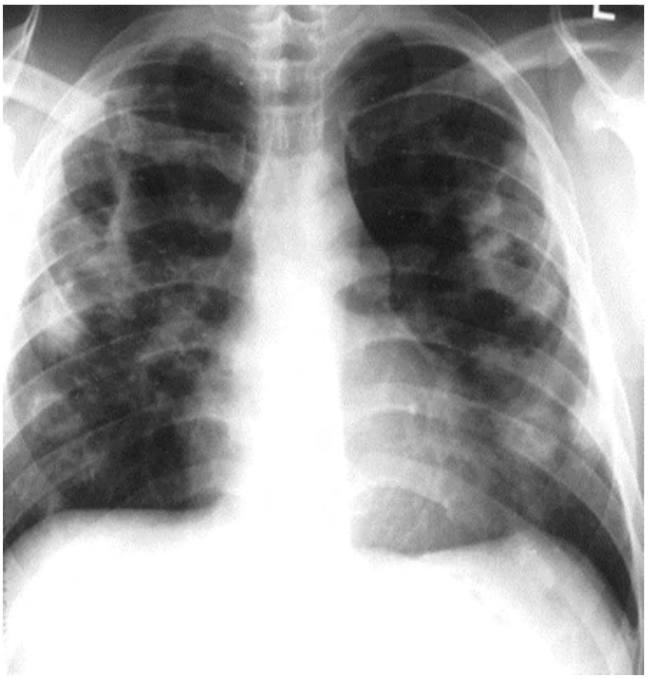
Case 3 -- CXR resolution



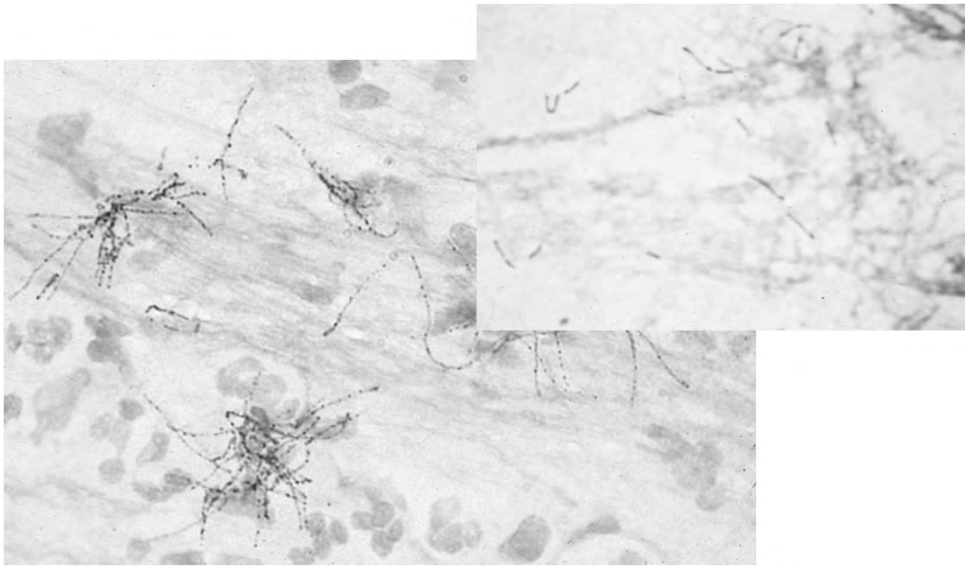
Case 4

- History
  - 57 year old woman
  - 3 weeks of fever, cough, and chest pain unresponsive to antibiotic treatment
  - Takayasu's arteritis on prednisone Rx
- Examination
  - T38, P100, R24, BP140/70
  - Chest clear but chest wall tender
- Laboratory
  - WBC normal, Glucose 240

Case 4 CXR



Case 4 aspirate

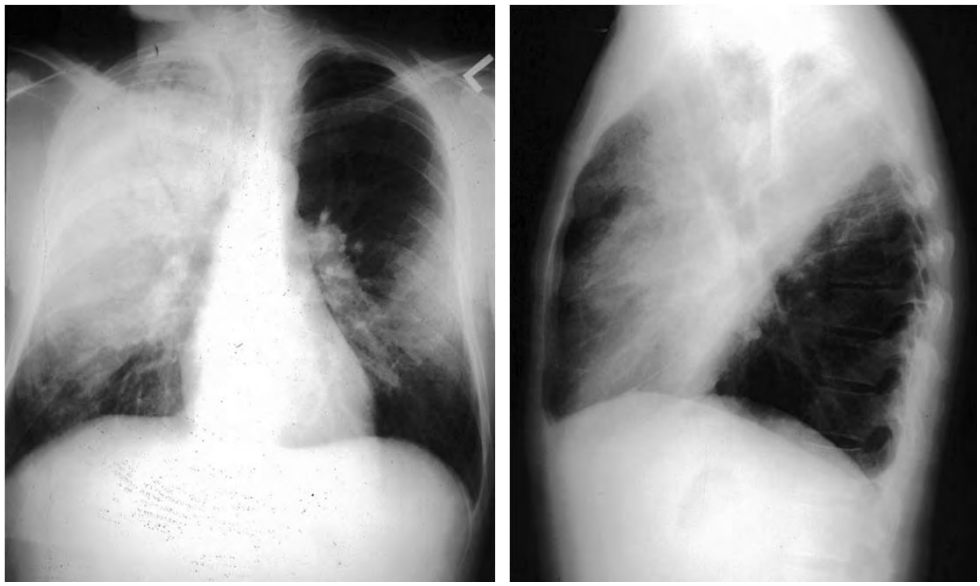


Pulmonary Nocardiosis

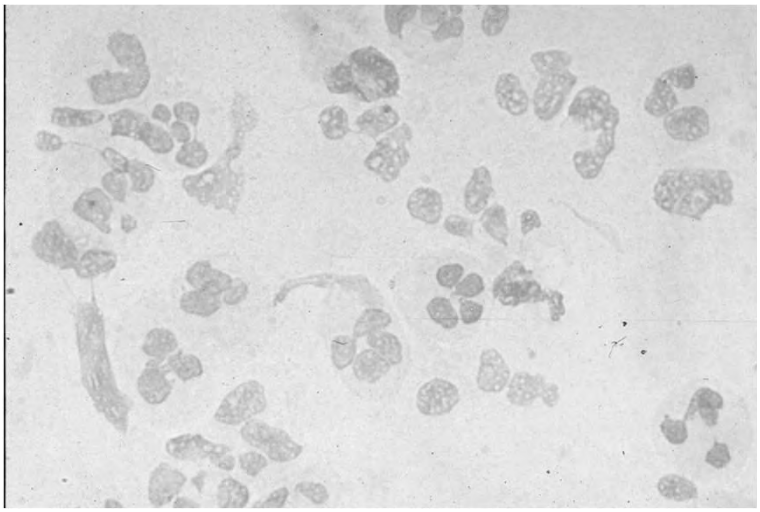
Case 5

- History
  - 63 year old man
  - 2 days high fever, chills, cough, and chest pain
  - s/p failed cadaveric renal transplantation now on HD
  - Bullous pemphigoid on prednisone/immuran Rx
- Examination
  - T39.0, P140, R32, BP150/70
  - Dyspneic and confused with consolidation of right chest
- Laboratory
  - WBC 22K, BUN/Cr 80/4.4, Glucose 68, CPK 541

Case 5 -- CXR



Case 5 -- sputum Gram stain



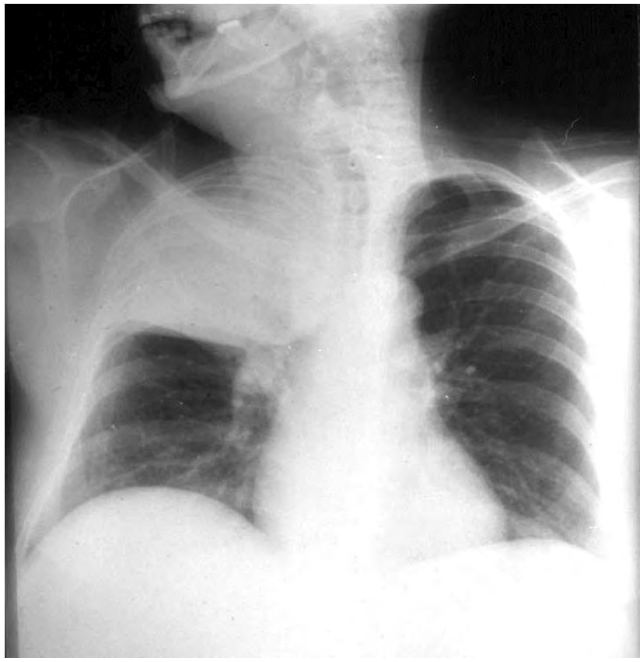
Purulent without organisms--*Legionella pneumophila*

Legionnaires' Disease

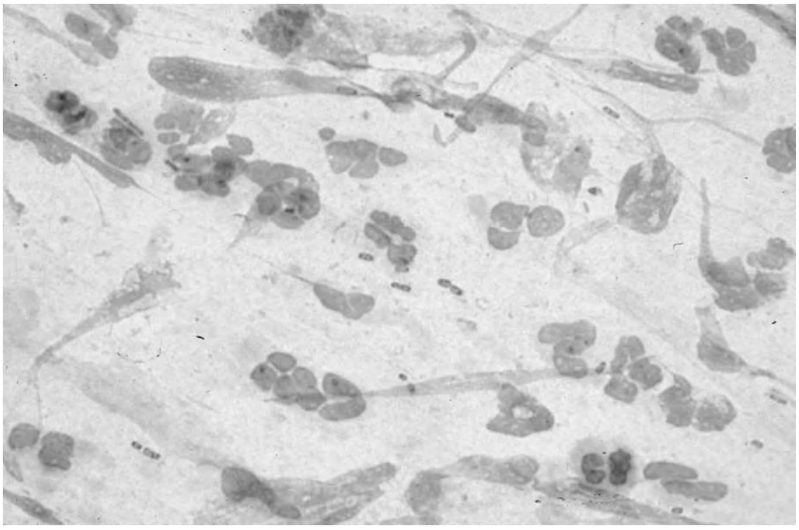
Case 6

- History
  - 68 year old homeless alcoholic man
  - 10 days ago myalgias, dry cough, sore throat
  - 2 days high fever, chills, cough, and chest pain
- Examination
  - T38.8, P130, R30, BP110/60
  - Tachypneic, tremulous, and confused with rattling cough
- Laboratory
  - WBC 20K, Bilirubin 3, ETOH 55

Case 6-- CXR



Case 6 -- sputum Gram stain



Klebsiella pneumoniae